Feasibility of Electron Cooling and Luminosity of EIC

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Abstract

Realization of beam recovery in superconducting linear accelerators and new concepts of beam transport: discontinuous solenoid, circulator rings, flat to round beam adapters – made feasible the efficient electron cooling for hadron beams in colliders. The precision requirements to beam alignments are relaxed of use of dispersive cooling. Cooling with flattened beams (at round beams in detectors) allows one to decrease the critical electron current against IBS and minimize the non-linear beam-beam disruptive effects.

The start rate of electron cooing is limited usually by a large ion beam divergence caused by the Coulomb repulsion at beam forming in low energy part of ion facility. A halo beam gymnastics in phase space is proposed in order to overcome the space charge limit and maintain beam emittance at a level that delivered from a linac while stacking and accelerating the beam in a booster.

Electron cooling in cooperation with a strong high frequency superconducting field allows one to obtain very short heavy particle bunches, hence, raising the luminosity by making a stronger final focusing. Very short bunches also make feasible the crab crossing for hadron beams, that allows one to remove the parasitic beam-beam interactions and maximize the collision rate.

Numerical examples are given.

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